

Benefits to the Europa Clipper Mission Provided by the Space Launch System

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Abstract

The National Aeronautics and Space Administration's (NASA's) proposed Europa Clipper mission would provide an unprecedented look at the icy Jovian moon, and investigate its environment to determine the possibility that it hosts life. Focused on exploring the water, chemistry, and energy conditions on the moon, the spacecraft would examine Europa's ocean, ice shell, composition and geology by performing 32 low-altitude flybys of Europa from Jupiter orbit over 2.3 years, allowing detailed investigations of globally distributed regions of Europa. In hopes of expediting the scientific program, mission planners at NASA's Jet Propulsion Laboratory are working with the Space Launch System (SLS) program, managed at Marshall Space Flight Center. Designed to be the most powerful launch vehicle ever flown, SLS is making progress toward delivering a new capability for exploration beyond Earth orbit. The SLS rocket will offer an initial low-Earth-orbit lift capability of 70 metric tons (t) beginning with a first launch in 2017 and will then evolve into a 130 t Block 2 version. While the primary focus of the development of the initial version of SLS is on enabling human exploration missions beyond low Earth orbit using the Orion Multi-Purpose Crew Vehicle, the rocket offers unique benefits to robotic planetary exploration missions, thanks to the high characteristic energy it provides. This paper will provide an overview of both the proposed Europa Clipper mission and the Space Launch System vehicle, and explore options provided to the Europa Clipper mission for a launch within a decade by a 70 t version of SLS with a commercially available 5-meter payload fairing, through comparison with a baseline of current Evolved Expendable Launch Vehicle (EELV) capabilities. Compared to that baseline, a mission to the Jovian system could reduce transit times to less than half, or increase mass to more than double, among other benefits. In addition to these primary benefits, the paper will also explore secondary effects, such as the elimination of the need to design for hot inner-solar-system conditions and gain permits for a radioisotope thermoelectric generator fly-by of Earth, are provided by the use of a direct trajectory transit instead of a more time-consuming gravitational-assist trajectory.